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B.Tech.
PEL5I101

5th Semester Regular Examination 2017-18
Power Electronics
BRANCH: EEE
Time: 3 Hours
Max Marks: 100
Q.CODE: B402

Answer Question No.1 and 2 which are compulsory and any four from the rest.
The figures in the right hand margin indicate marks.

Q1   **Answer the following questions:** *multiple type or dash fill up type*   **(2x10)**

a) The maximum di/dt in an SCR is,
(i) directly proportional to Vm of supply voltage
(ii) inversely proportional to Vm of supply voltage
(iii) directly proportional to L in the circuit
(iv) inversely proportional to L in the circuit

b) Two identical SCRs are connected back to back in series with a load. If each SCR is fired at 900, a PMMC voltmeter across the load would read
(i) peak voltage
(ii) $(1/2) \times$ peak voltage
(iii) $(1/\pi) \times$ peak voltage
(iv) zero

c) A forward voltage can be applied to an SCR after its
(i) anode current becomes zero
(ii) anode voltage becomes zero
(iii) anode voltage and anode current become zero at the same time
(iv) gate current becomes zero

d) In a single-phase full converter, for continuous conduction, each pair of SCRs conduct for _____.

e) In a three phase, half-wave diode rectifier, the ratio of average output voltage to per phase maximum a.c. voltage is,
(i) 0.955   (ii) 0.827
(iii) 1.654   (iv) 1.169

f) Why is a resistor connected across the gate and cathode of an SCR?
(i) To protect against high di/dt
(ii) To bypass the noise signal
(iii) To protect against overvoltage
(iv) To protect against high temperature rise

g) A chopper can be used on
(i) pulse-width modulation only   (ii) frequency modulation only
(iii)amplitude modulation only   (iv) both PWM and FM

h) A single-phase bridge inverter can be designed by having thyristors without forced commutation circuitry if the load it is handling is
(i) series combination of resistance and a large inductance
(ii) series combination of resistance and a large capacitance
(iii) series combination of resistance, inductance and capacitance with resonant frequency of the circuit being lower than the inverter switching frequency
(iii) series combination of resistance, inductance and capacitance with resonant frequency of the circuit being higher than the inverter switching frequency

i) SMPSs are superior to linear power supplies in respect of,
(i) size and efficiency
(ii) efficiency and regulation
(iii) regulation and noise
(iii) noise and cost

j) In a single phase to single phase step-down cycloconverter,
(i) all SCRs must carry currents for equal duration
(ii) the duration of currents in all SCRs cannot be equal
(iii) the duration of currents in all SCRs may or may not be equal
(iii) all SCRs must carry currents for equal duration for dependable operation

Q2 **Answer the following questions: *Short answer type*** **(2x10)**
a) What are the difference between IGBT and MOSFET
b) Give two examples of voltage controlled semiconductor devices.
c) What do you mean by latching current and holding current of an SCR?
d) Define displacement factor and form factor.
e) Why pulse triggering is preferred to dc triggering?
f) What is the effect of source inductance on load voltage?
g) What do you mean by converter grade SCRs and Inverter grade SCRs?
h) A single-phase, half bridge inverter has input voltage of 48V DC. Inverter is feeding a load of 2.4 ohm. What will be the rms output voltage at fundamental frequency?
i) What is the function of feedback diode and where is it used?
j) What do you mean by string efficiency? How is it related to derating factor of a string?

Q3 **a)** Draw the static V~I characteristic of an SCR and explain. Discuss the methods of triggering of an SCR. **(10)**
b) A 3 KV, 750 A power electronic circuit has thyristors with 800 V and 175 A rating. Using a derating of 25%, find the number of thyristors in series and parallel. **(5)**

Q4 **a)** Discuss on switching characteristics of GTO during turn-on and turn-off processes. **(10)**
b) Discuss inverting mode of operation of single phase full wave controlled rectifier. **(5)**

Q5 **a)** Explain the operation with associated waveforms of a three-phase fully controlled bridge rectifier with resistive and inductive (R-L) load for 60^0 firing angle. Derive the expression for average output voltage. **(10)**
b) An R-L load, energized from single phase, 230V, 50Hz source through a single thyristor, has R=10 ohm and L=0.08 henry. If it is triggered in every positive half cycle at $\alpha=75^0$, find current expression as function of time. **(5)**

Q6 **a)** Draw complete protection circuit of an SCR and discuss briefly. **(10)**
b) Explain single phase cycloconverter with suitable diagram. **(5)**

Q7 **a)** With all the waveforms, explain the circuit operation of type-D chopper. **(10)**
b) Explain Buck converter operation with circuit diagram and waveforms. **(5)**

Q8 **a)** Draw and explain for three phase voltage source bridge type of inverter operating under 120^0 mode. **(10)**
b) Explain the SPWM technique used for voltage control. **(5)**

Q9 **a)** What are the different control strategies of AC voltage controller? Explain briefly with circuit diagram and waveforms. **(10)**
b) Write short notes on SMPS. **(5)**